

GC Solutions for Oil & Gas Analysis

SciSpec Co., Ltd.

Presented by Pojanun (PJ)



A night sky filled with stars and the Milky Way galaxy, with several large satellite dishes in the foreground. The dishes are silhouetted against the dark sky, and the Milky Way is visible as a bright, hazy band of light stretching across the upper half of the image. The foreground shows the dark silhouettes of the dishes and some structures, with a range of mountains in the background.

THE JOURNEY OF OIL & GAS Analysis

THE JOURNEY OF OIL & GAS



Fine Chemical

- MTBE/Benzene/Toluene
- Lube Oil / Wax
- Cl₂/NaOH
- Solvents

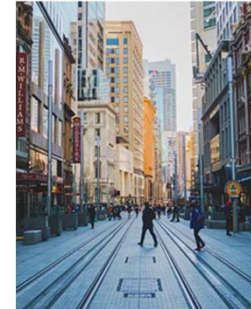


C₂/C₃ Cracker

- Ethylene/Propylene
- Thermal Cracker
 - PDH

Specialty

- Bulk Gases: N₂/O₂/Argon
- Flue Gas /Emission
- Envir. Impact/ Ozone Precursor



Polymer

- PE/HDPE/LDPE /LLDPE
- PVC/PS/PET



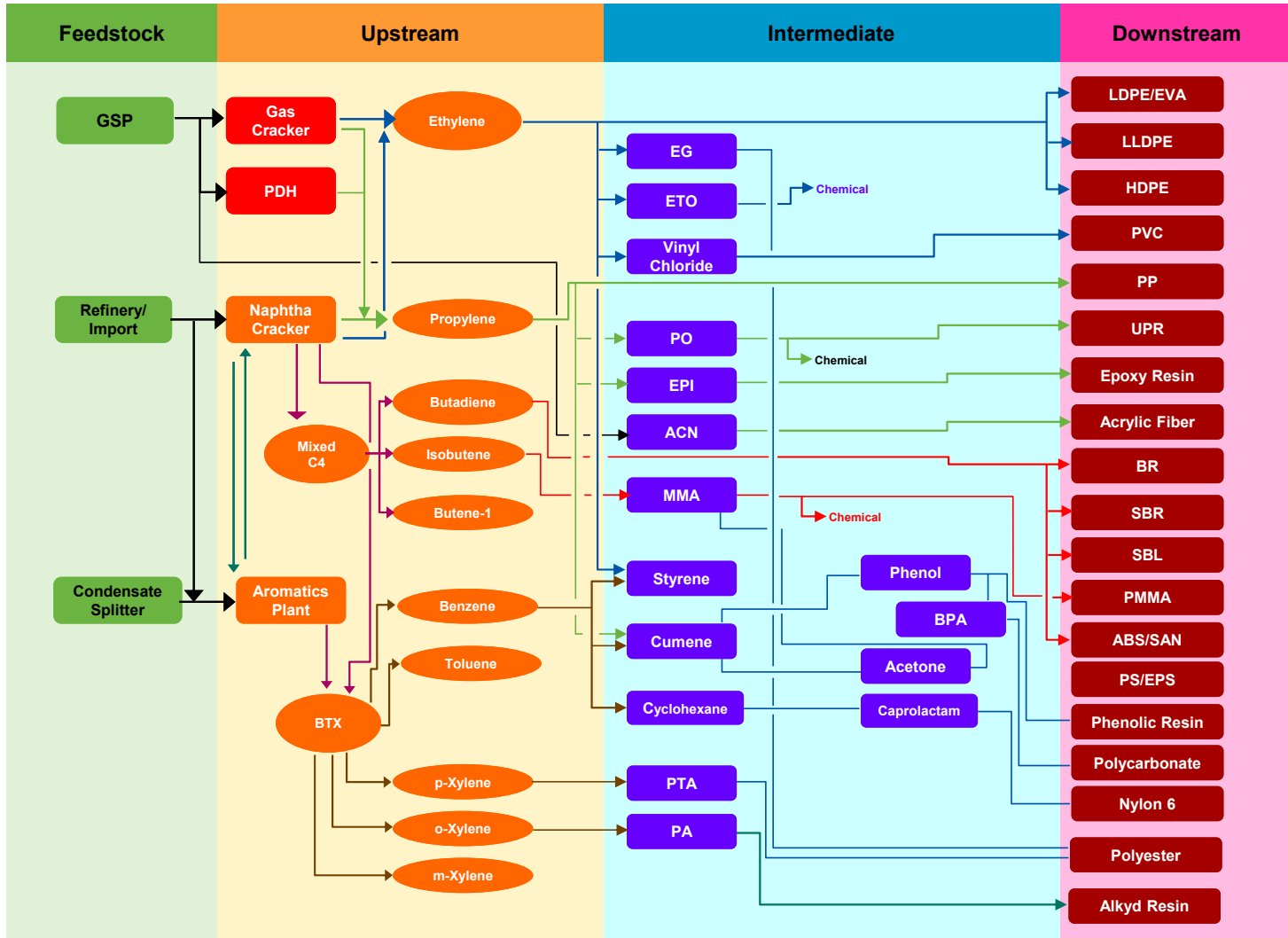
Refinery

- Crude Oil Process / Distillation
- LPG/Gasoline/Jet/Diesel



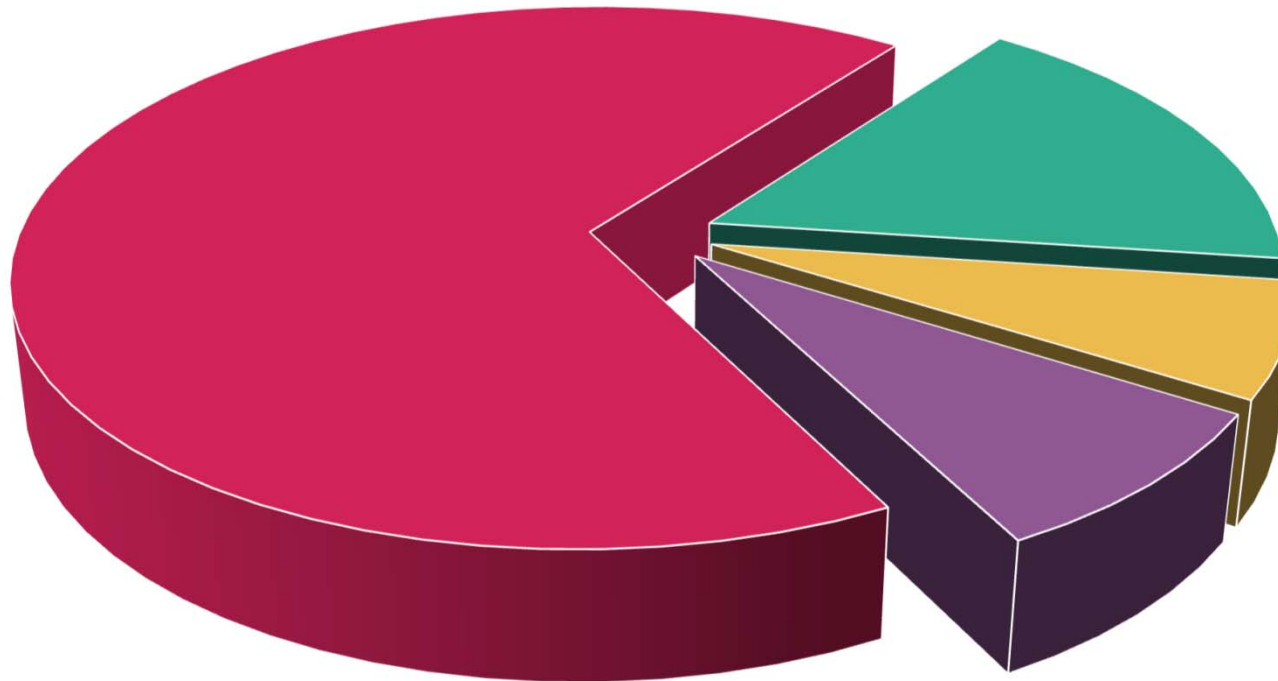
PETROCHEMICAL

Up & Down Streams



Typical Petrochemical Laboratory service

Laboratory Analysis



■ Water Analysis ■ Hydrocarbons Analysis ■ Environmental Analysis ■ Innovative Solutions

chromatography is everywhere

*Everything is
possible*



**Sci
Spec**

chemical • food & flavor • environmental • forensic • **petrochemical** • pharmaceutical • education

Chromatography is everywhere



Sample Introduction Technique

Many Sample introduction Techniques coupling with GC available below

- Gas & Liquid Injection (can be Autosampler)
 - Head Space (Static)
 - Purge & Trap (Dynamic)
 - Thermal Desorption
 - Gas Sampling Valve
 - Pyrolyzer
 - SPME (Solid Phase Micro-Extraction)
-

Sample Introduction Technique

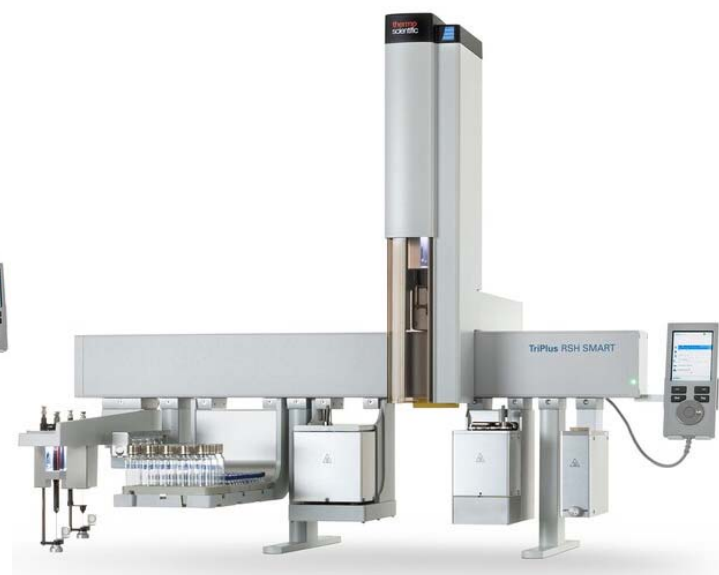
Liquid Autosampler Injection



GC Trace1610 with AS



GC Trace1610 MS with
TriPlus RSH SMART



TriPlus RSH SMART
- Multiple Tools

Sample Introduction Technique

Head-space Autosampler (Static)



**GC Trace1610 with
TriPlus™ 500 (120 Vials)**



**TriPlus™ 500
With Short Transfer line**



**TriPlus™ 500
With Long Transfer line**

Sample Introduction Technique

Purge & Trap Autosampler (Dynamic)



**Atomx XYZ™
Purge & Trap Autosampler**



GC Trace1610

Sample Introduction Technique

GAS SAMPLING VALVE



TRACE™ GC1610
with Application Module



Application Module

- 6 rotor valves Or 8 diaphragm valve
- 2 Detectors on Application module (Total 4 (5 for MS) Detectors)
- A Secondary oven or A Methanizer

Trace16xx Series

Trace1600 and 1610 GC



TRACE™ GC1600



TRACE™ GC1610
with Touch Screen

Trace1610 GC

- ✓ Large high-resolution touchscreen
- ✓ Multi-language
- ✓ Status information
- ✓ Real-Time signal
- ✓ Run log
- ✓ Consumables usage tracking
- ✓ Interactive graphics and video tutorial



TRACE™ GC1610
with Touch Screen



Trace1610 GC

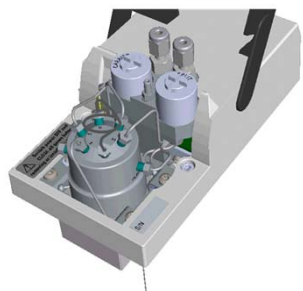
Injector Module



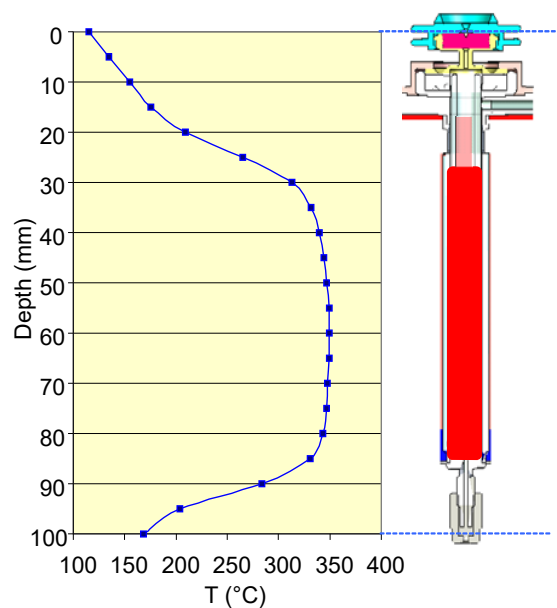
Split/splitless injector (SSL)



Programmable temperature vaporizing injector (PTV)

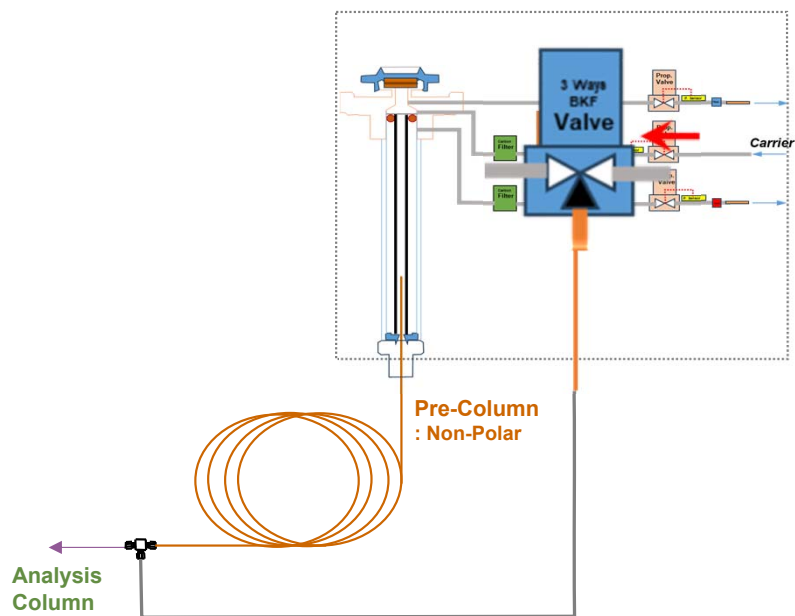


Gas Sampling valve

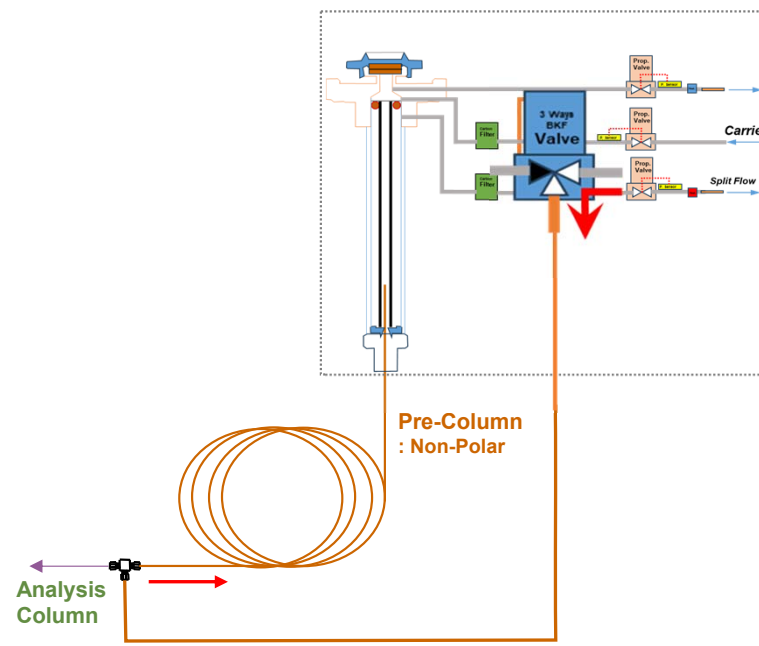


Trace1610 GC

Injector Module with Backflush capability



Normal Analysis



Backflush Mode

Trace1610 GC

Detector Module



Flame Ionization
Detector (FID)



Thermal Conductivity
Detector (TCD)



Electron Capture
Detector (ECD)



Nitrogen Phosphorous
Detector (NPD)



Flame Photometric
Detector (FPD)



Pulsed Discharge
Detector (PDD)

Standard Oil & Gas Analyzer and Customized Solutions



Standard Analyzer

World Wide Testing Methods

- ❑ ASTM, ISO, GPA ...
- ❑ Turnkey Analyzers



Standard Analyzer

Refinery
Gas Analyzer

Natural
Gas Analyzer

Trace CO/CO2
Gas Analyzer

TOGA [DGA]
Analyzer

Trace Sulfurs
Analyzer

Customized
Analyzer

Products Gas
Analyzer

Trace Light
Gases Analyzer

Trace [LOWOx]
Oxygenates

LPG
Analyzer

Oxygenates
In Gasoline

DHA
Analyzer

SimDist
Analyzer

Wet Cl2
Analyzer

BioDiesel
Analyzer

Green House
Gases Analyzer

Standard Analyzer

**Refinery
Gas Analyzer**

**Natural
Gas Analyzer**

**Trace CO/CO2
Gas Analyzer**

**TOGA [DGA]
Analyzer**

**Trace Sulfurs
Analyzer**

**Customized
Analyzer**

**Products Gas
Analyzer**

**Trace Light
Gases Analyzer**

**Trace [LOWOx]
Oxygenates**

**LPG
Analyzer**

**Oxygenates
In Gasoline**

**DHA
Analyzer**

**SimDist
Analyzer**

**Wet Cl2
Analyzer**

**BioDiesel
Analyzer**

**Green House
Gases Analyzer**

Refinery Gas Analyzer

- ✓ **RGA FAST**
 - ⋮ UOP 539, DIN 51666
- ✓ **Packed + capillary columns**
 - ⋮ Analysis time: 8 minutes
- ✓ **3 Channels simultaneous**
 - ⋮ It can be add-in the fourth channel such as trace Sulfurs [totally 4 channels]



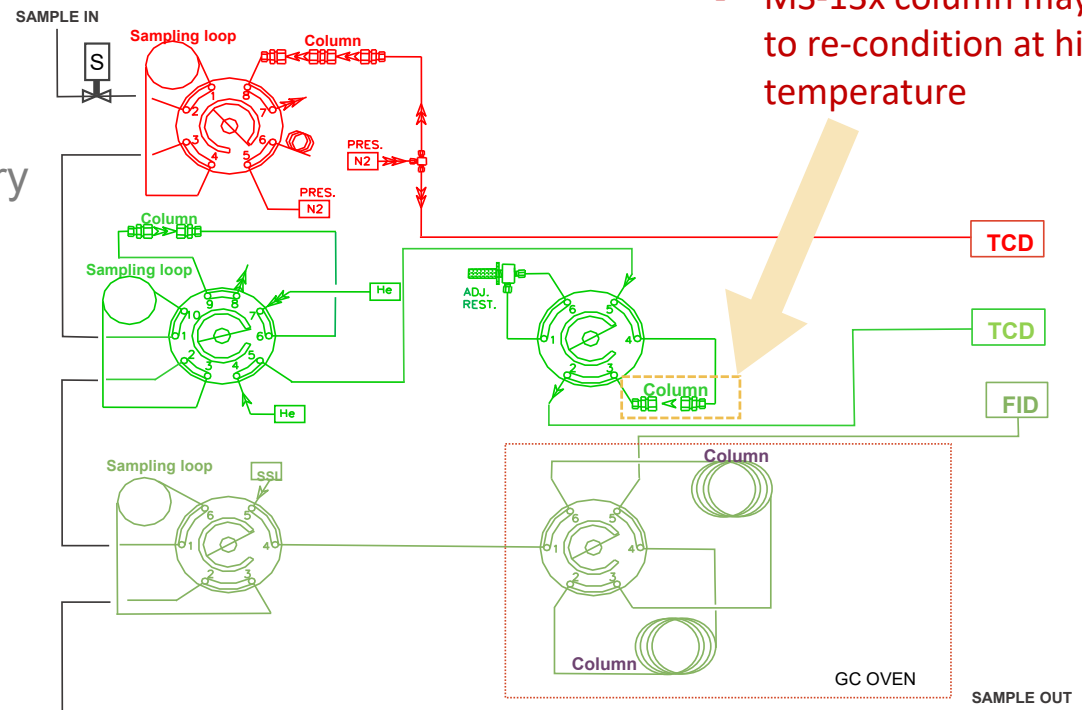
Trace 1610 GC
with Application Module



Refinery Gas Analyzer

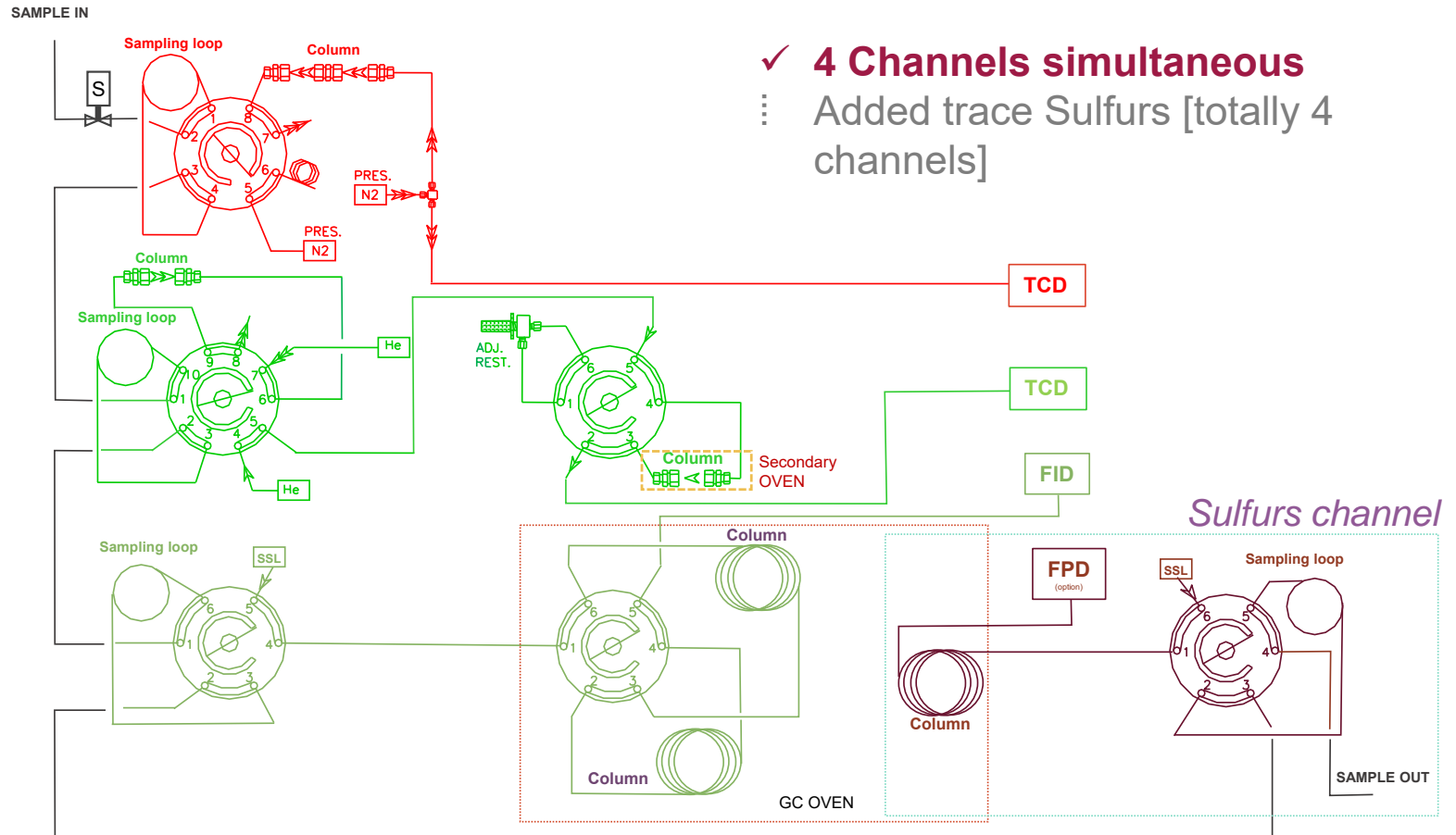
Hardware configuration : with sample balance pressure

- ✓ **Worry free of samples difference pressure**
 - ⋮ With sample pressure balance
- ✓ **MS-13X column recondition**
 - ⋮ The system able to add-in secondary oven



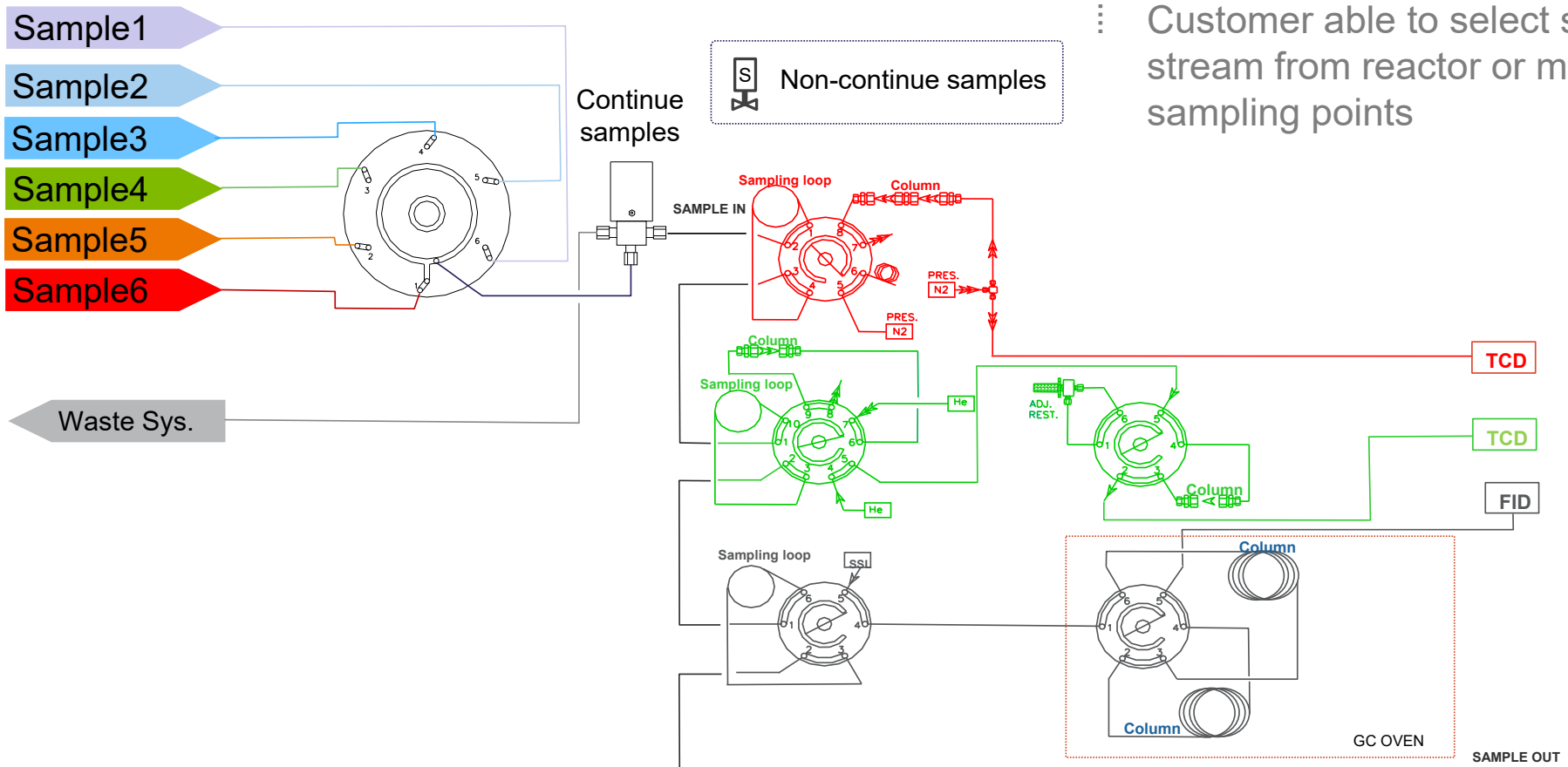
Refinery Gas Analyzer

Hardware configuration : with fourth channel of trace sulfurs



Refinery Gas Analyzer

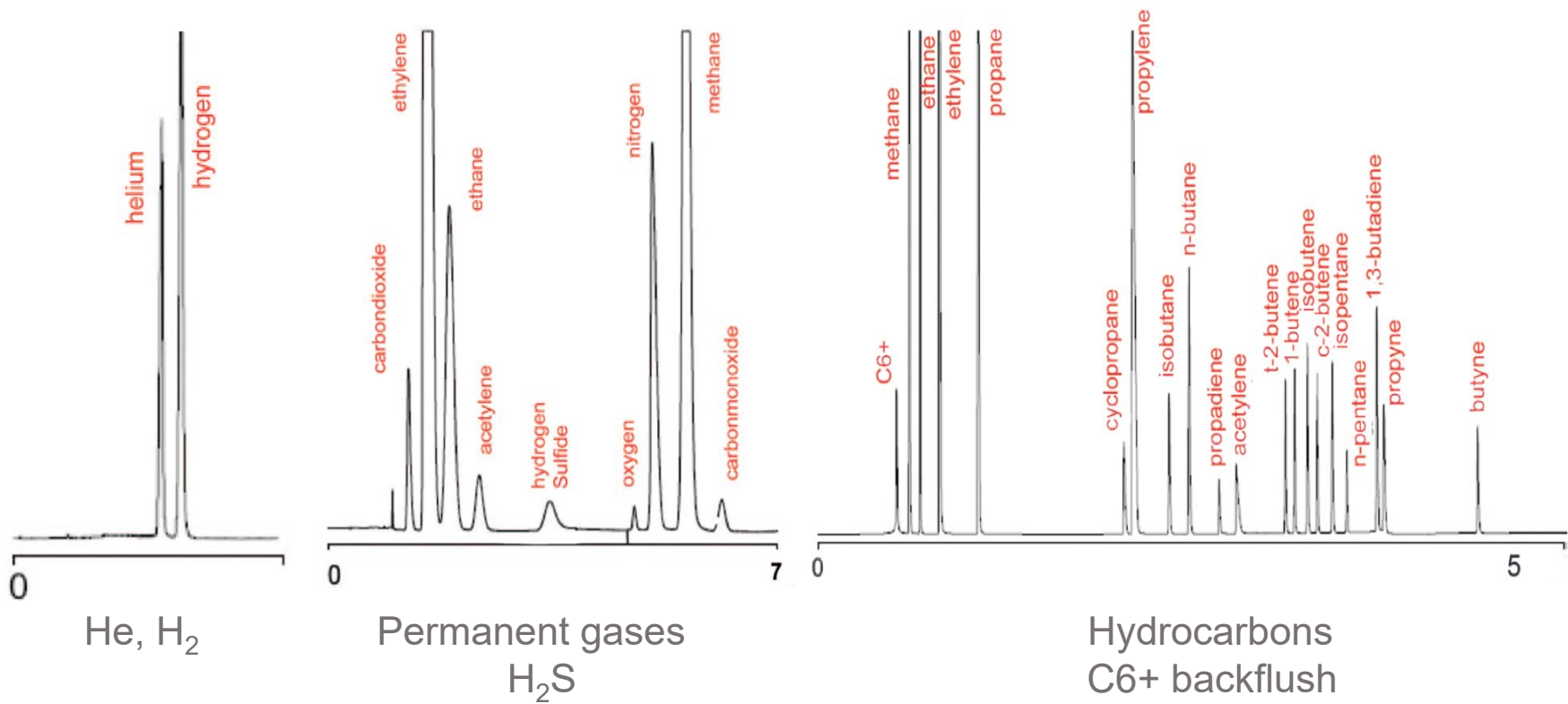
Hardware configuration : with multi-streams selector [fully control from single PC



- ✓ **Continue or Non-continue**
- ⋮ Customer able to select sample stream from reactor or multiple sampling points

Refinery Gas Analyzer

Chromatograms



Standard Analyzer

Refinery
Gas Analyzer

Natural
Gas Analyzer

Trace CO/CO₂
Gas Analyzer

TOGA [DGA]
Analyzer

Trace Sulfurs
Analyzer

Customized
Analyzer

Products Gas
Analyzer

Trace Light
Gases Analyzer

Trace [LOWOx]
Oxygenates

LPG
Analyzer

Oxygenates
In Gasoline

DHA
Analyzer

SimDist
Analyzer

Wet Cl₂
Analyzer

BioDiesel
Analyzer

Green House
Gases Analyzer

Natural Gas Analyzer



Natural Gas Analyzer

many different international standards and configurations



Most seen:

: GPA 2261
: ASTM 1945
: ISO 6974



Options:

Capillary column: C3-C12 (↑) : GPA 2286
Liquid sampling : GPA 2177
Capillary column + liquid sample : GPA 2186

Natural Gas Analyzer

Flexible configurations

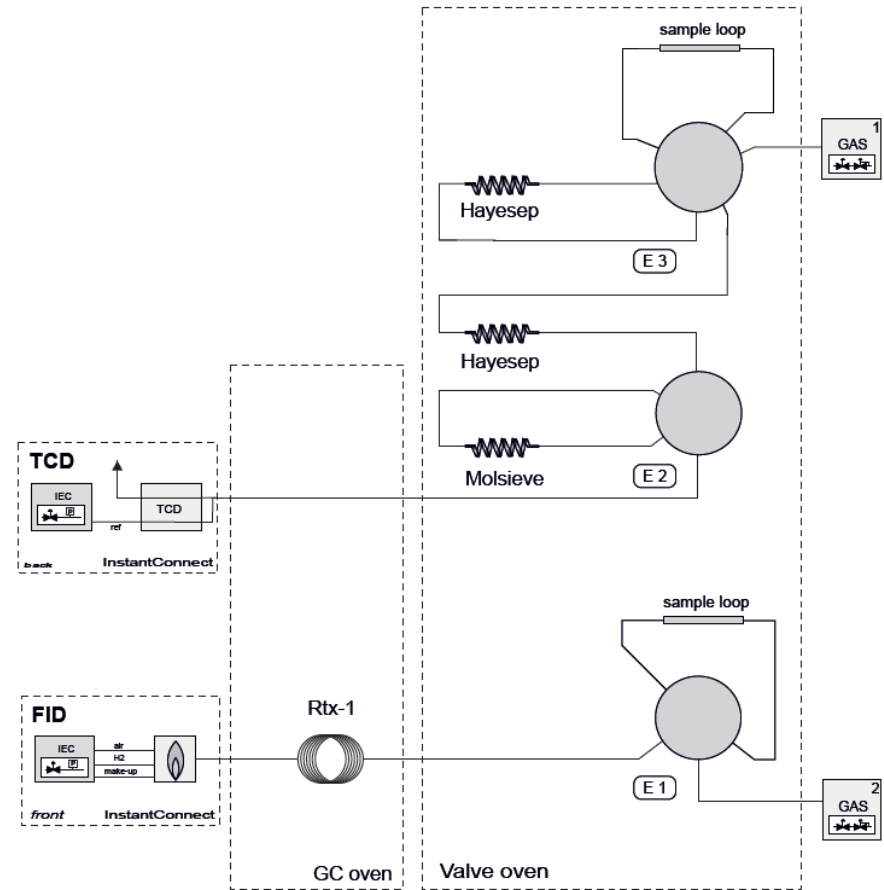


✓ **TCD Channel**

- ⋮ C3+, CO2, C2, H2S, O2, N2, C1

✓ **MS-13X column recondition**

- ⋮ C1-C20



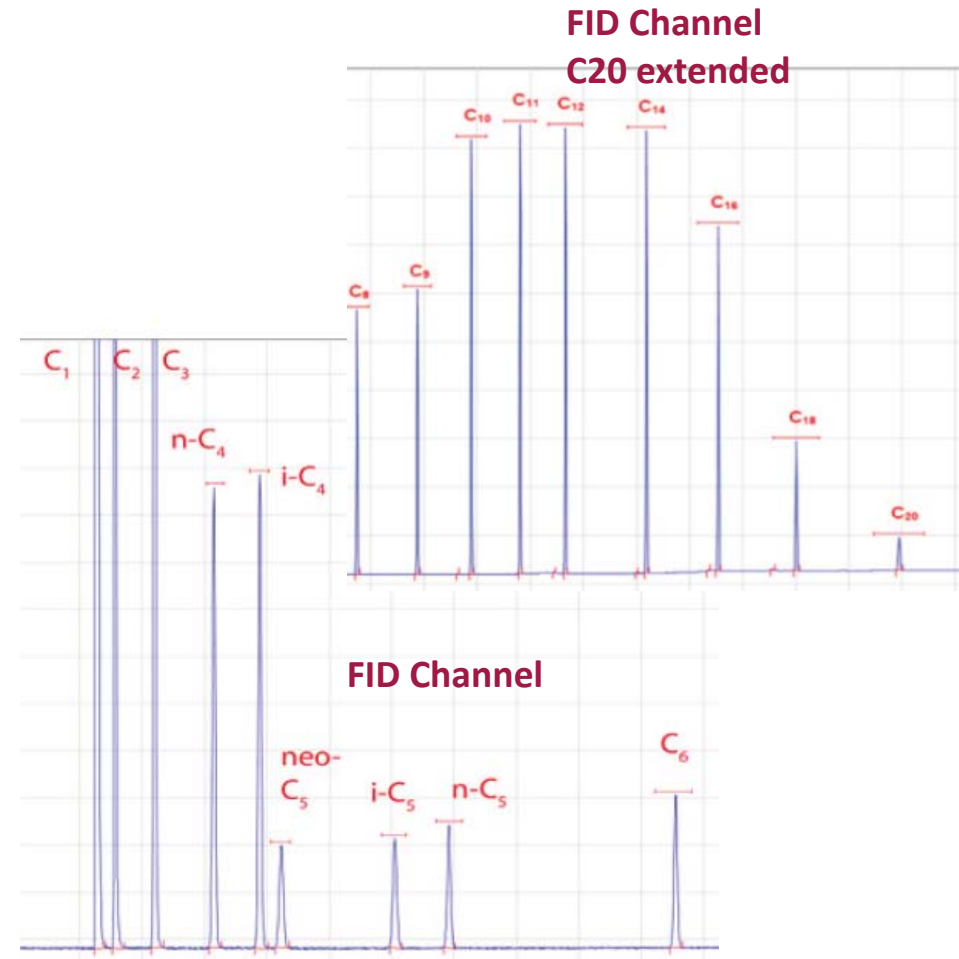
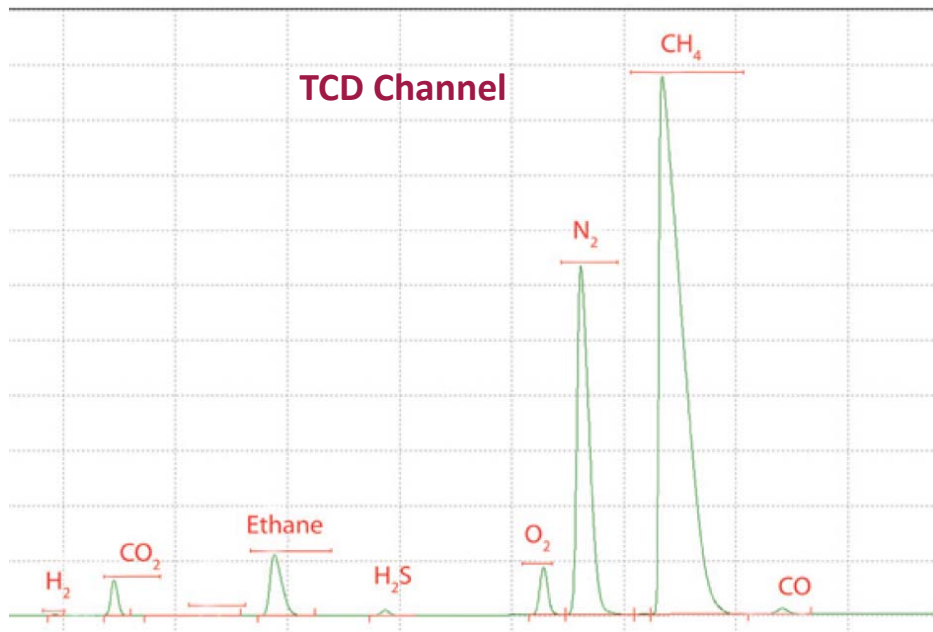
Natural Gas Analyzer

✓ TCD Channel

⋮ C3+, CO2, C2, H2S, O2, N2, C1

✓ FID Channel

⋮ C1-C20



Natural Gas Analyzer

Calorific value calculation

Natural gas calculations			
Instrument	Trace1300 NGA	Sequence name	Data G.A.S. NGA pack
Instrument Method	initial gas injection	Data Vault	ChromeleonLocal
Processing Method	New Processing Method	Report Template	G.A.S. NGA Report Template

Natural gas calculations

Instrument	Trace1300 NGA	Sequence name	Data G.A.S. NGA pack
Instrument Method	initial gas injection	Data Vault	ChromeleonLocal
Processing Method	New Processing Method	Report Template	G.A.S. NGA Report Template
Data File	NG		
Injection Date	08/		
Injection Time	13:		
Calculation Type	Tot		

Composition report (mol %)

Component Name	Retention min	Area pA*min	Amount mol%
Propane	1.537	48.055	1.000
2-Methylpropane	1.918	12.705	0.200
n-Butane	2.240	12.784	0.200
2,2-Dimethylpropane	2.400	3.985	0.050
2-Methylbutane	3.381	3.887	0.050
n-Pentane	3.866	3.909	0.050
n-Hexane	5.709	4.688	0.050
Carbon Dioxide	3.053	9.390	1.499
Ethane	4.913	24.868	4.000
Nitrogen	8.215	24.166	3.998
Methane	9.517	395.946	89.035
Dihydrogen sulphide	4.170	0.022	0.001
Carbonyl Sulfide	4.863	0.001	0.001
Methylmercaptan	8.075	0.048	0.001



Physical property rep

Metering at 0°C and 101.3 kPa	Mc
Sup. Calorific Value	
Inf. Calorific Value	
Mean mol weight	
Compression factor	
Relative Density	
Density	
Metering at 15°C and 101.3 kPa	Mc
Sup. Calorific Value	
Inf. Calorific Value	
Mean mol weight	
Compression factor	
Relative Density	
Density	
Metering at 20°C and 101.3 kPa	Mc
Sup. Calorific Value	
Inf. Calorific Value	
Mean mol weight	
Compression factor	
Relative Density	
Density	

Standard Analyzer

Refinery
Gas Analyzer

Natural
Gas Analyzer

Trace CO/CO2
Gas Analyzer

TOGA [DGA]
Analyzer

Trace Sulfurs
Analyzer

Customized
Analyzer

Products Gas
Analyzer

Trace Light
Gases Analyzer

Trace [LOWOx]
Oxygenates

**LPG
Analyzer**

Oxygenates
In Gasoline

DHA
Analyzer

SimDist
Analyzer

Wet Cl2
Analyzer

BioDiesel
Analyzer

Green House
Gases Analyzer

LPG Analyzer

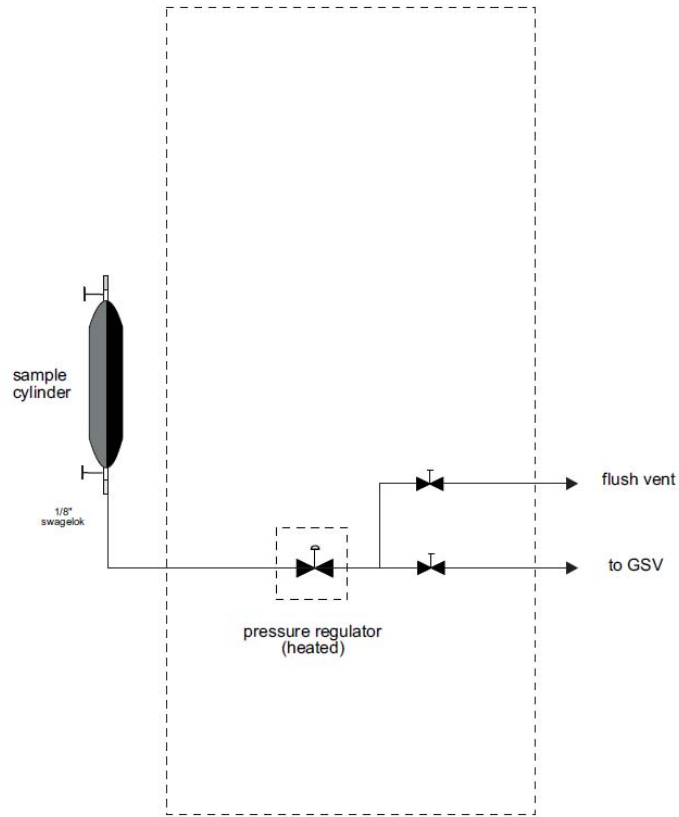
GSV : with vaporizer

LSV : with Liquefied securitiser



LPG Analyzer

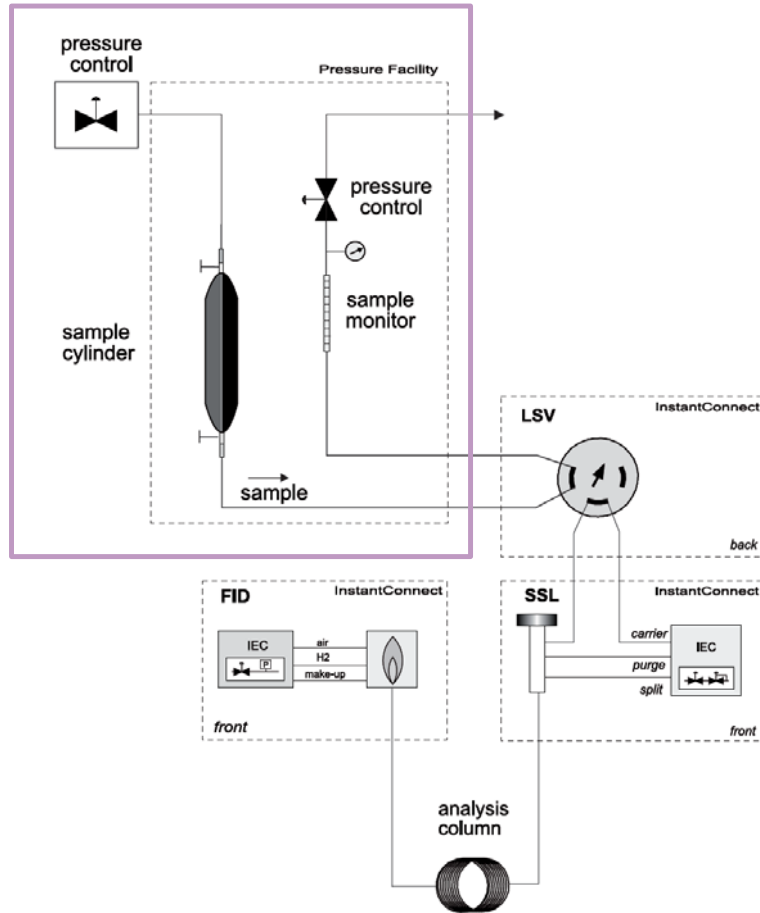
GSV : with vaporizer and up to C5



LPG Analyzer

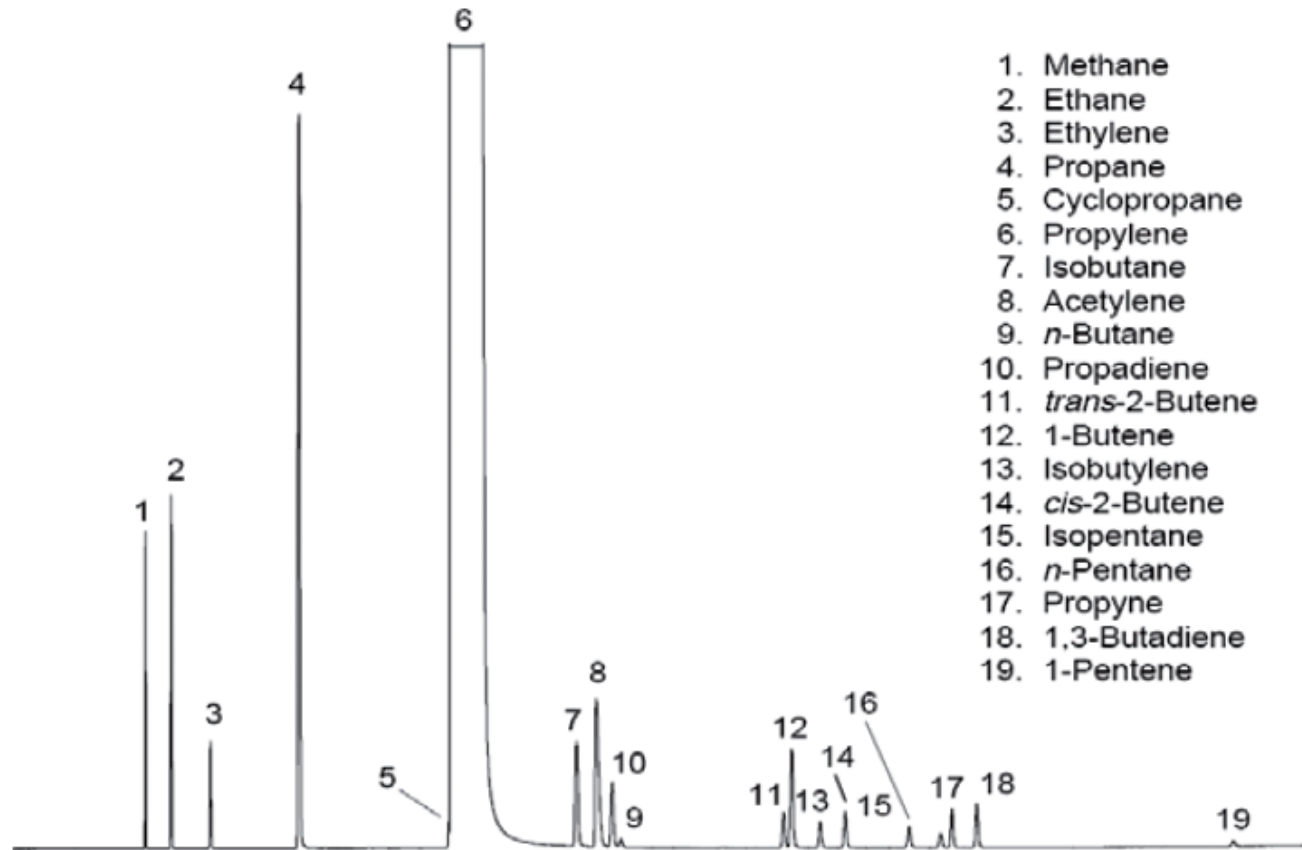
LSV : with LPG securitiser and up to C10

LSV



LPG Analyzer

Chromatogram : Impurities in Propylene



Standard Analyzer

Refinery
Gas Analyzer

Natural
Gas Analyzer

Trace CO/CO2
Gas Analyzer

TOGA [DGA]
Analyzer

Trace Sulfurs
Analyzer

Customized
Analyzer

Products Gas
Analyzer

**Trace Light
Gases Analyzer**

Trace [LOWOx]
Oxygenates

LPG
Analyzer

Oxygenates
In Gasoline

DHA
Analyzer

SimDist
Analyzer

Wet Cl2
Analyzer

BioDiesel
Analyzer

Green House
Gases Analyzer



Trace Light Gas Analyzer

Bulk Gases :



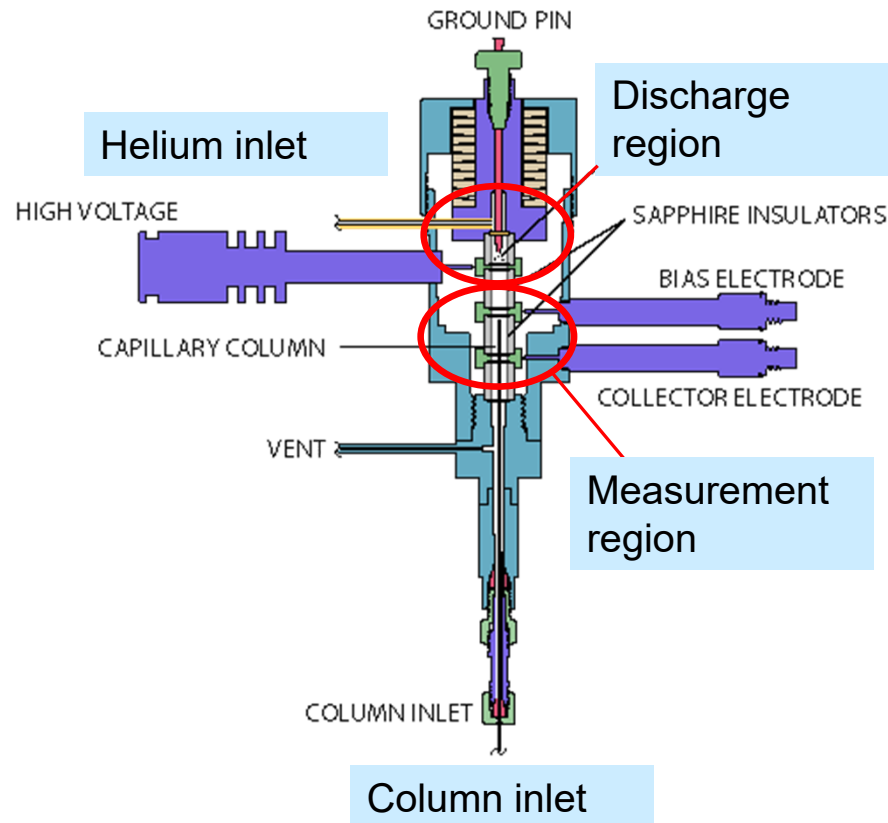
Trace Light Gas Analyzer

Impurities in Bulk Gases : ppb to ppm levels [ASTM D2504 & 2505]

- Inert gases (H₂, He, N₂, Xe, Kr, Ne)
- Light HC
- CO₂ for beverage
- CF₄, SF₆
- Sulphur
- Formaldehyde
- NH₃
- N₂O
- Nobel gases

Trace Light Gas Analyzer

Pulse Discharge Detector:

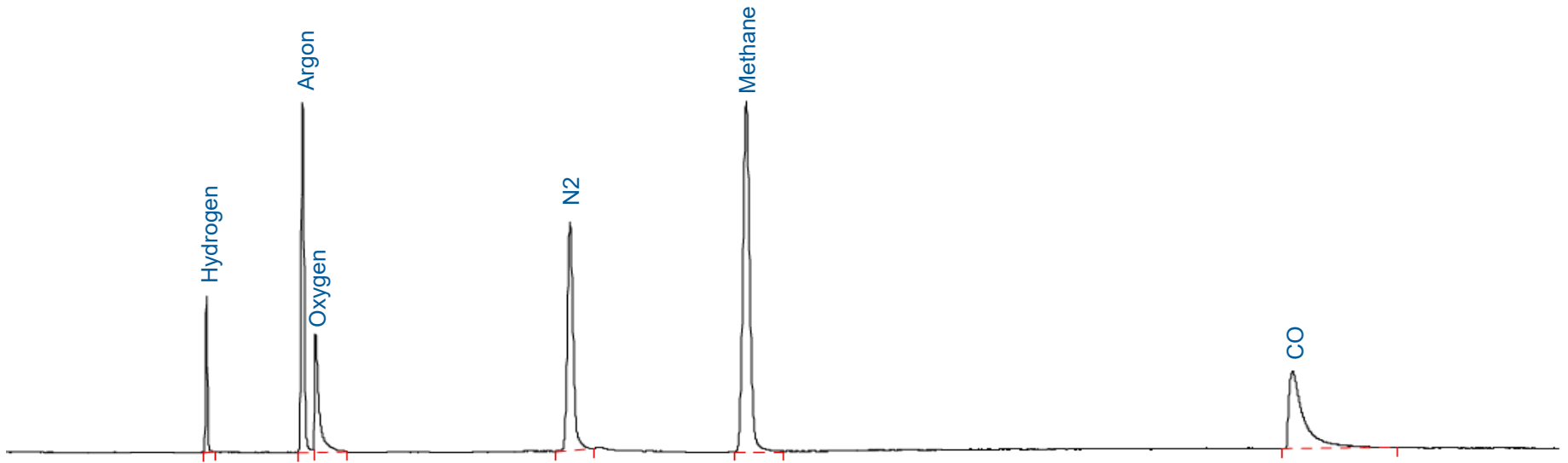


Pulsed Discharge Detector (PDD)

- Ionisation by pulsed DC Helium discharge ('Hopfield' emission)
- Universal (not for He)
- 10–30 ppb detection limit

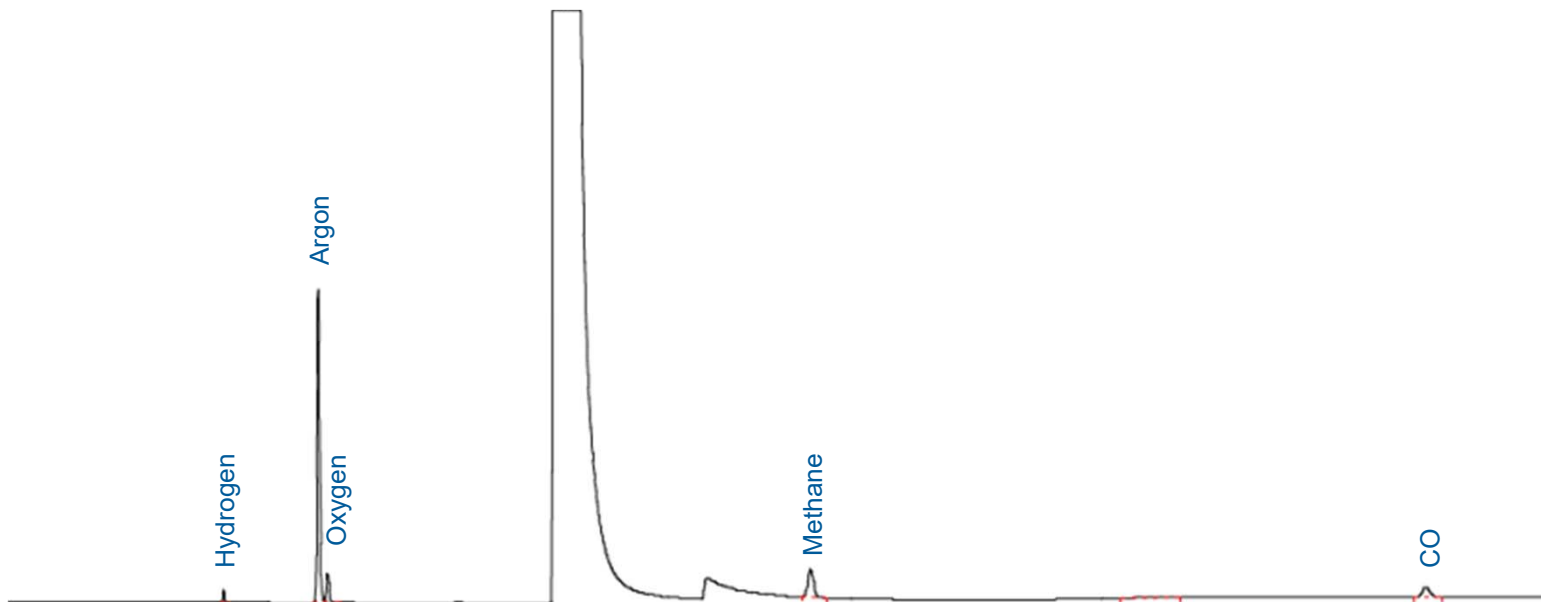
Trace Light Gas Analyzer

Chromatogram : 2 ppm of H₂,Ar,O₂,N₂, CH₄ and CO in Helium



Trace Light Gas Analyzer

Chromatogram : Impurities of H₂, Ar, O₂, CH₄ and CO in Nitrogen



Standard Analyzer

Refinery
Gas Analyzer

Natural
Gas Analyzer

Trace CO/CO2
Gas Analyzer

TOGA [DGA]
Analyzer

Trace Sulfurs
Analyzer

Customized
Analyzer

Products Gas
Analyzer

Trace Light
Gases Analyzer

Trace [LOWOx]
Oxygenates

LPG
Analyzer

Oxygenates
In Gasoline

DHA
Analyzer

SimDist
Analyzer

Wet Cl2
Analyzer

BioDiesel
Analyzer

Green House
Gases Analyzer

Trace Sulfurs Analyzer

Detectors VS Sensitivity :

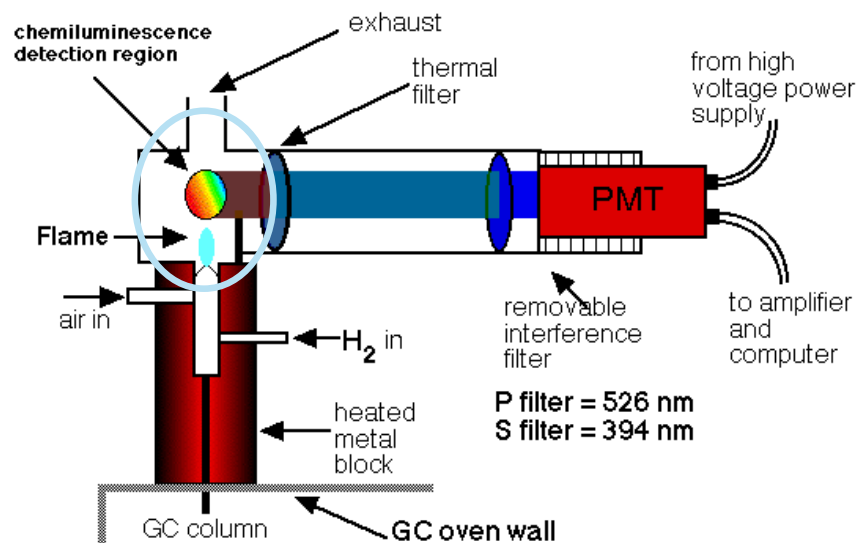


Detector	LOD
TCD	low ppm
FPD	100-200 ppb
PFPD	< 25 ppb
SCD	< 10 ppb
MS	< 1 ppb

Trace Sulfurs Analyzer

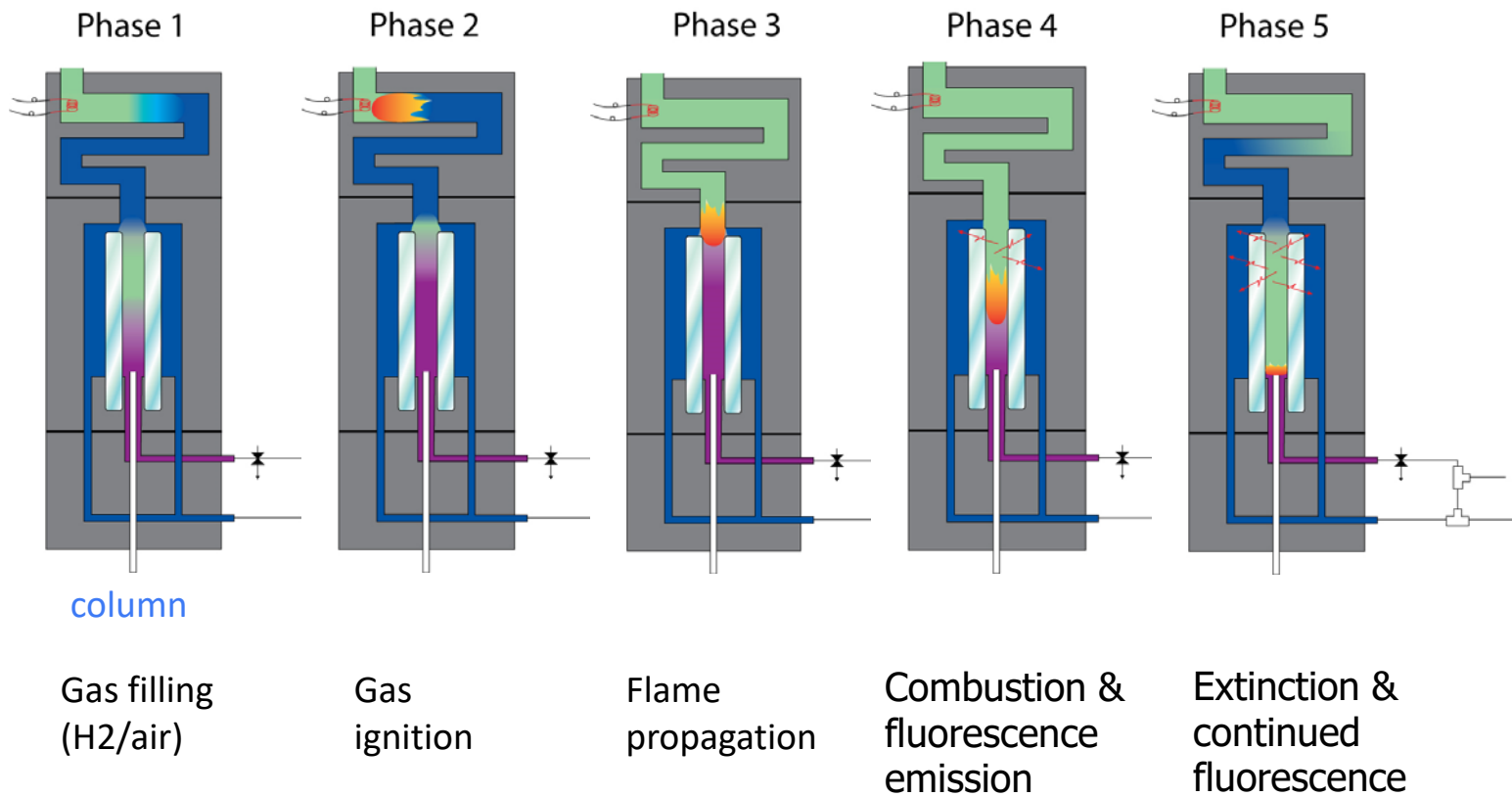
FPD : Overview

Sulfur forms an excited dimer (S_2^*) that emits a characteristic light energy as it returns to ground state.



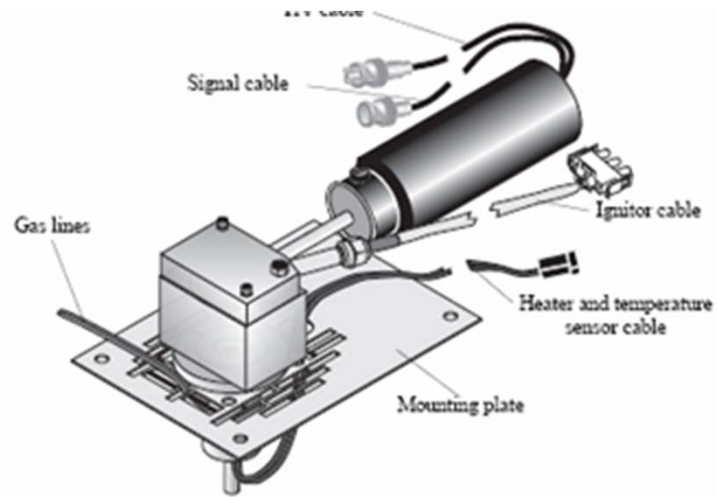
Trace Sulfurs Analyzer

PFPD : Overview

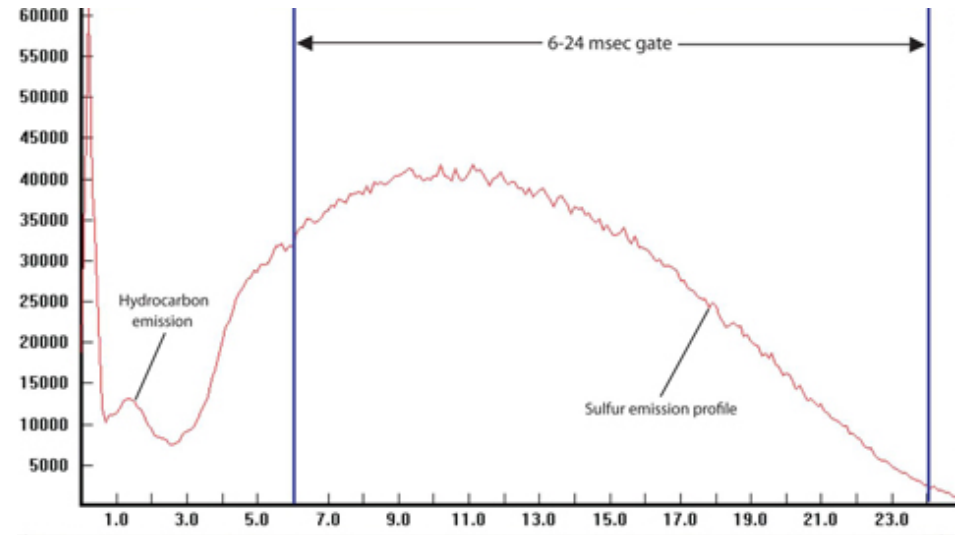


Trace Sulfurs Analyzer

PFPD : Overview

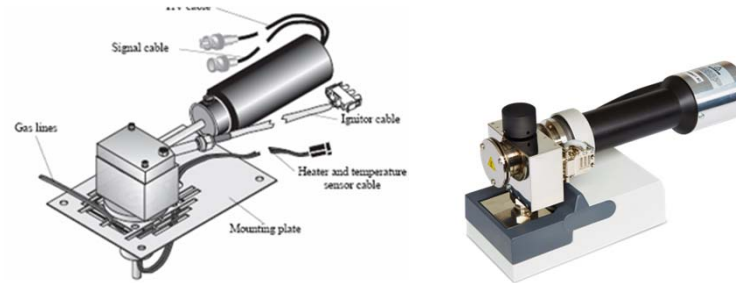


propagating flame results in light emissions with specific luminescent spectra and lifetimes



Trace Sulfurs Analyzer

PFPD VS FPD : Comparison LOD

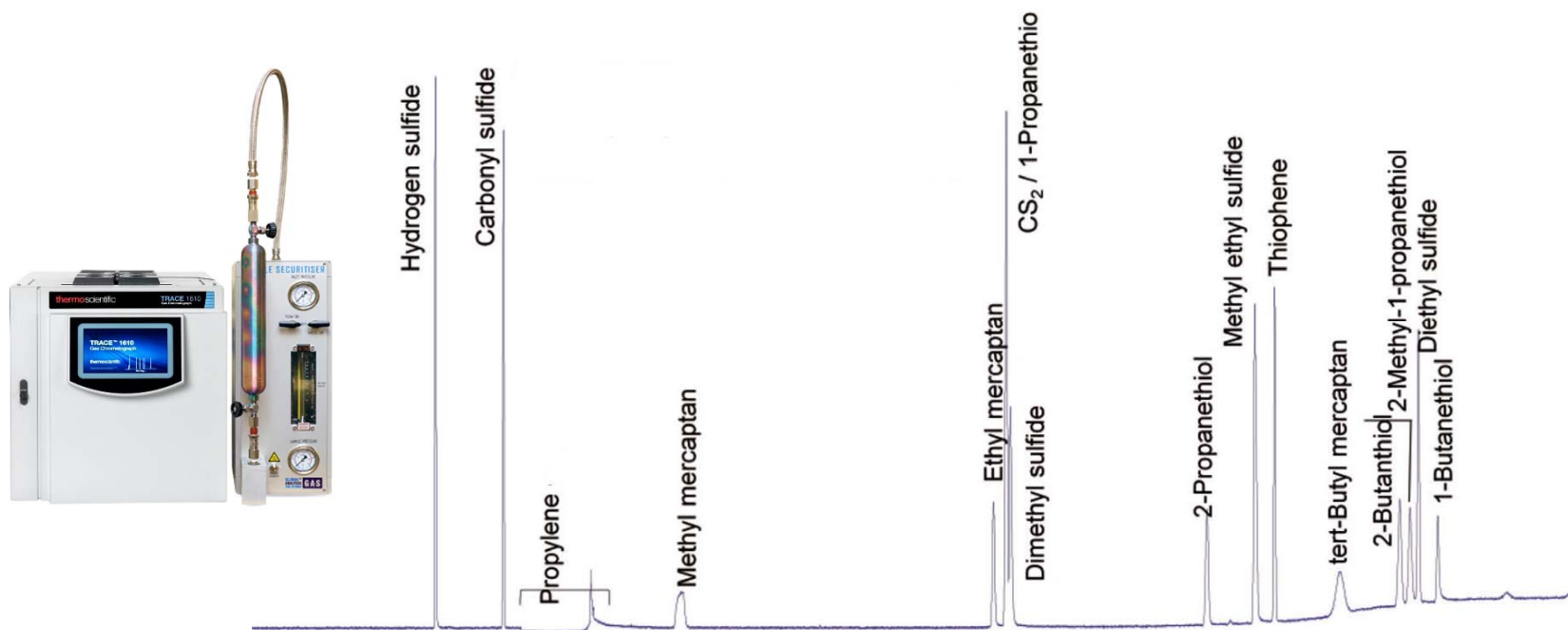


Component	LOD (ppb)	
	PFPD	FPD
H ₂ S	33	176
COS	31	158
CS ₂	35	196
C ₂ H ₆ S	41	206
CH ₄ S	18	90

PFPD is 5 * more sensitive than FPD
(linearity and selectivity are comparable)

Trace Sulfurs Analyzer

Chromatogram: Propylene sample (Sulfurs spiked) with PFPD



Trace Sulfurs Analyzer

With Mass Spectrometer: LOD below 1 ppb

MS with AEI (Advanced Electron Impact):

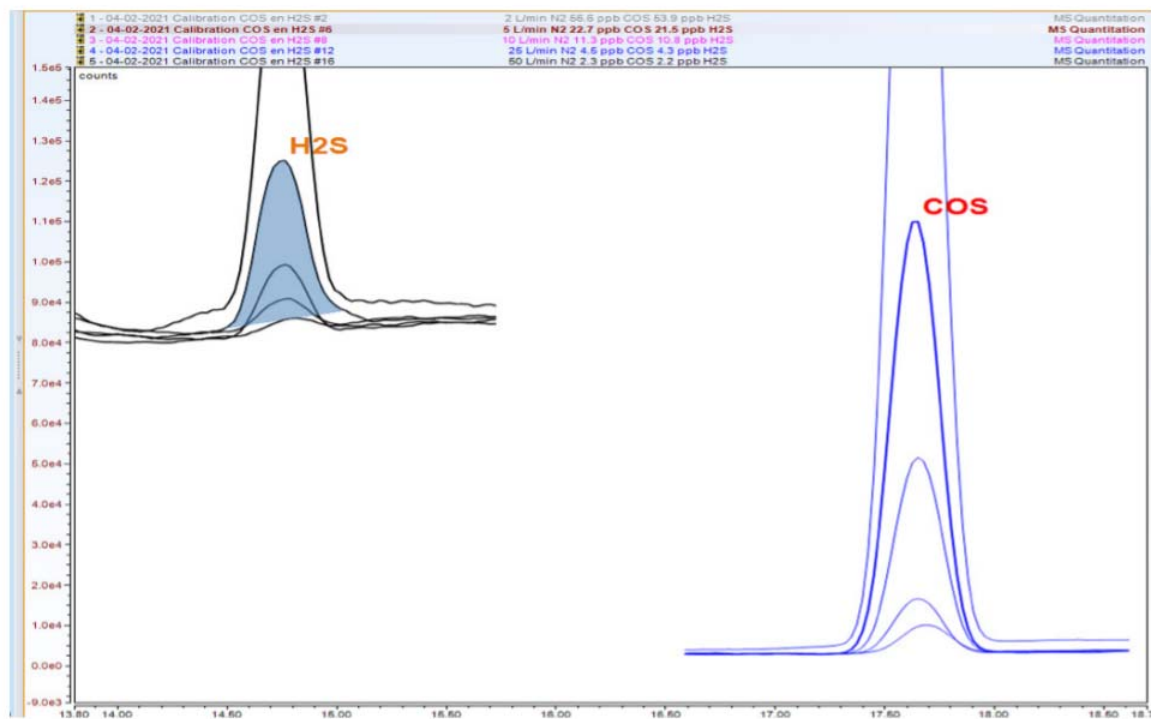


Figure 6. Overlay of 5 H₂S/COS concentration levels:

H₂S: 2.2, 4.3, 10.8, 21.5 and 53.9 ppb

COS: 2.3, 4.5, 11.3, 22.7 and 56.6 ppb

Customized Analyzer

Refinery
Gas Analyzer

Natural
Gas Analyzer

Trace CO/CO₂
Gas Analyzer

TOGA [DGA]
Analyzer

Trace Sulfurs
Analyzer

Customized
Analyzer

Products Gas
Analyzer

Trace Light
Gases Analyzer

Trace [LOWOx]
Oxygenates

LPG
Analyzer

Oxygenates
In Gasoline

DHA
Analyzer

SimDist
Analyzer

Wet Cl₂
Analyzer

BioDiesel
Analyzer

Green House
Gases Analyzer

Customized Analyzer

Everything is possible

Understand customer sample

☐ Fill up AEQ FORM

[ANALYZER ENGINEERING QUESTIONNAIRE]

☐ Analyzer design base on AEQ

☐ Analyzer can be In-house method

☐ Turned Key analyzer with ready

“Unpack and Run”



Customized Analyzer

AEQ FORM

Both Standard & Customized Analyzer included

Shipped with FAT¹ & SAT² Report

All of tested documents are archived

All of special parts and materials were recorded in database

"Unpack and Run"

1 Factory Acceptance Tested

2 Site Acceptance Tested

ANALYZER ENGINEERING QUESTIONNAIRE

Complete and return to SciSpec Company Limited:

E-mail: info@scispec.co.th

Customer Information

Name:	Date:
Company:	Phone:
Address:	Fax:
Address:	E-mail:
Address:	

Sales Contact Information

Name:	Date:
Location:	Phone:
E-mail:	Fax:

Sample Information (1) List ALL components for each sample. (2) Specify component's unit e.g. %, ppm, ppb etc. (3) Use an "X" to indicate the components of interest.

Component	sample 1 <small>(Specify wt%, vol %, ppm, ppb, etc.) (Specify all components in the sample)</small>					sample 2 <small>(Specify wt%, vol %, ppm, ppb, etc.) (Specify all components in the sample)</small>					sample 3 <small>(Specify wt%, vol %, ppm, ppb, etc.) (Specify all components in the sample)</small>					sample 4 <small>(Specify wt%, vol %, ppm, ppb, etc.) (Specify all components in the sample)</small>				
	Min.	Unit	Max.	Unit	"X"	Min.	Unit	Max.	Unit	"X"	Min.	Unit	Max.	Unit	"X"	Min.	Unit	Max.	Unit	"X"
H2O																				
Stream Temperature																				
Stream Pressure																				
Analysis Time																				
Analysis Cycle Time																				

- Notes:
- 1. If stream(s) change temperature or pressure, indicate sample composition changes that are possible
 - 2. If any components in the stream(s) polymerize or decompose, indicate temperature at which the change(s) occur
 - 3. All samples must be free of all particulates. Indicate if sample contains particulates.
 - 4. Do not use "0" to indicate the minimum concentration.
 - 5. To save in analyzer cost, don't over specify the requirement.

Q & A

